

Programme of “Dispositivi Elettronici” “Electron Devices”:		
Number of ECTS credits: 9 (workload is 225 hours; 1 credit = 25 hours)		
I0023 e I0565 Compulsory 2nd Cycle in ELECTRONIC ENGINEERING, 1nd year , 1st semester		
Teacher: Vincenzo Stornelli / Pasquale Carelli		
1	Course objectives and Learning outcomes	<p>The goal of this course is to provide the main concepts on crystallography, electronic and phonon transport theory, techniques of solid state physics of semiconductor junctions between semiconductors, main solid state devices. The main electron device types are described, together with the relevant equivalent model CAD.</p> <p>On successful completion of this module, the student should understand the advanced knowledge about the properties of the main solid state devices with a strong insight into the physical basis of their operation.</p>
2	Dublin descriptors	<p>Topics of the module include:</p> <p>Outline of the basic atomic structure of matter: classification of solids. Elements of classical statistics: the classical Drude model of the electron, the Sommerfield model for electrons, transport properties in quantum mechanics. Semiconductor physics: semiconductor real simplified model, occupation of the states, holes and electrons, doped semiconductors, measurement of doping, transport in semiconductors, measuring characteristics of semiconductor pn junction, depletion region, current-voltage characteristic. Heterojunction. Metal semiconductor junction. The SPICE model of the MOSFET. Flash Memory: physical structure, behavior and modeling. Heterojunctions and compound semiconductors, Superlattices. Heterojunction electronic devices: the bipolar transistor (HBT) and field effect transistors (HEMT), Light Emitting Diodes, pn junctions and heterojunctions. Simulation-based physics: Boltzmann transport equation, models and algorithms. Coupling with the electromagnetic field. Laboratory: Measurement of the junction diode (Gummel plot). Simple circuits with LEDs and photodiodes.</p> <p>On successful completion of this module, the student should</p> <ul style="list-style-type: none"> - have profound knowledge of the basic principles of operation of electron devices, - have knowledge and understanding of the relevant CAD design methods. - understand and explain the behaviour of the physic based simulation methods; - demonstrate capacity for solving problems in the operation of semiconductor devices.
3	Prerequisites and learning activities	The student must have basic notions in electronics and physics, contained in the exams of Physics I and Elettronica I.
4	Teaching methods and language	Lectures and exercises. Language: Italian/English Ref. Text book S.M. Sze, Semiconductor devices: physics and technology, J. Wiley & Sons (2002)
5	Assessment methods	Written and Oral exam.